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Pemberian Azoalla dan Pupuk Kandang Kambing untuk Meningkatkan Hara N dan Pertumbuhan Tanaman Padi Sawah (*Oryza sativa* L.)

*Providing azolla and goat manure to increase nutrient N and growth of lowland rice (Oryza sativa **L.**)*

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ABSTRACT

One of the problems in the paddy field is the lack of availability of nutrient N in paddy soil, it can be overcome by giving azolla and goat manure. The aimis to determine the effect of giving azolla and goat manure for increasing the nutrient N and the growth of rice plant. This research used factorial Random Group Design (RAK) with two treatment factors and three replications. The first factor is azolla dose (0, 7 tons / ha) and the second factor is goat manure dose (0, 5, 10, 15 tons / ha). This research is implemented in the greenhouse of the Faculty of Agriculture, University of North Sumatra, Medan. The result of the study indicated giving of azolla increased C-organic, N-total, N content and N uptake of plant. Giving goat manure at a dose of 15 tons / ha increased C-organic, number of tillers, canopy dry weight, root dry weight, N content of N uptake. Providing azolla and goat manure 5 tons/ha the highest increased N uptake of plants and growth of lowland rice plants

Keywords: Azolla, Goat manure, Nitrogen, Rice plant

ABSTRAK

Salah satu masalah di lahan sawah adalah kurang tersedianya hara N di tanah sawah. Hal tersebut dapat diatasi dengan memberikan azolla dan pupuk kandang kambing. Penelitian ini bertujuan untuk mengetahui pengaruh pemberian azolla dan pupuk kandang kambing terhadap peningkatan hara N dan pertumbuhan tanaman padi. Penelitian ini menggunakan Rancangan Acak Kelompok faktorial dengan dua faktor perlakuan dan tiga ulangan. Faktor pertama dosis azolla yaitu (0 dan 7 ton/ha) dan faktor kedua dosis pupuk kandang kambing yaitu (0, 5, 10, 15 ton/ha). Penelitian ini dilaksanakan di rumah kaca Fakultas Pertanian Universitas Sumatera Utara, Medan. Hasil penelitian menunjukkan pemberian azolla meningkatkan C-organik, N-total, kandungan N dan serapan N tanaman. Pemberian pupuk kandang kambing pada dosis 15 ton/ha meningkatkan C-organik, jumlah anakan, bobot kering tajuk, bobot kering akar, kandungan N dan serapan N. Pemberian azolla dan pupuk kandang kambing 5 ton/ha paling tinggi meningkatkan Serapan N tanaman serta pertumbuhan tanaman padi sawah

Kata kunci: Azolla, Pupuk kandang kambing, Nitrogen, Tanaman padi

INTRODUCTION

Rice is the main commodity of food crops which is the main food ingredient for the people of Indonesia. Based on BPS (2018), the area of rice paddy harvest in Indonesia in the January-September period was 9.54 million hectares with a production of 49.65 million tons of Dry Milled Grain (GKG). Indonesia's population continues to increase, so food needs continue to grow. Conversely, the area of productive land is relatively fixed or even shrinking. Increased production can be done by maintaining or improving the fertility status of the paddy fields.

Paddy fields often experience a decrease in soil fertility and productivity. Wetland productivity decreases due to transportation and nutrient loss due to harvest carried out and is not returned after harvest, excess from nutrient supply due to unbalanced fertilization, decreased levels of soil organic matter and low availability of macro nutrients (Setyorini *et al*, 2010).

Therefore organic fertilizers are used to repair soil damage that occurs as a result of continuous use of inorganic fertilizers. The use of organic matter can improve the physical properties of the soil, soil chemistry, and soil biology and can increase the C-organic content of the soil so that nutrients from fertilizer become more available to plants and can increase fertilizer efficiency. Organic materials used such as Azolla and goat manure.

Azolla that used is the type of Azolla microphylla. Azolla is a type of algae plant that can be used as a green fertilizer that is able to meet the nutrient needs of N for plants. The ability of Azolla to provide N for plants is because Azolla contains *Cyanobacteria*, *Anabaena azollae* which can fix N_2 in the air so that it can contribute N needs for plants (Sudjana, B. 2014). Azolla has N content: 2.14%, P: 0.96%, K: 2.64%, C-organic: 37.9% (Syamsiyah *et al*, 2016). The provision of Azolla as much as 6 tons / ha can increase the growth of rice plants, especially the weight of dry rice which is 4.66 tons / ha and can reduce the use of urea fertilizer.

Goat manure is one of the organic fertilizers that can increase soil pH after the incubation period and significantly influences the total N soil after the incubation period (Handayani, 2011). Goat manure has nutrient content that is relatively more balanced than other animal manure. Comparison of the elements contained in manure depends on the ratio of food and types given (Suharyanto and Rinaldi, 2002). Goat manure has high levels of N elements, namely 0.7% N and C/N of 20-25 (BPPP, 2006). According to Handayani (2011), giving goat manure as much as 6 tons / ha can increase total N soil, soil pH, plant height, number of tillers, canopy dry weight and root dry weight in 4 weeks incubation time.

Based on the description above, it is necessary to conduct research that aims to determine the effect of giving azolla and goat droppings in increasing nutrient N and the growth of lowland rice (*Oryza sativa* **L.**).

MATERIALS AND METHODS

This research was conducted at the Greenhouse and Research and Technology Laboratory of the Faculty of Agriculture, University of North Sumatra, Medan with a height of ± 25 m above sea level from May 2019 to October 2019.

The materials used in this study are examples of paddy soil as a medium for growing plants, rice seed varieties Mekongga as an indicator plant, goat manure as organic material, Azolla as green fertilizer, urea fertilizer, SP-36, and KCL as basic fertilizers and chemicals that are used for soil analysis in the laboratory.

The tools used in this study were hoes to take soil samples, pots as soil containers, digital scales for weighing fertilizers, ovens drying canopy dry weights, plastic as containers for soil samples, label paper as markers for each treatment, plastic labels as place labels, and other laboratory equipment for analysis needs in the laboratory.

This study used a factorial randomized block design with 2 treatment factors and 3 replications. Factor I: Azolla dose (A) consists of two levels A0 = 0 tons / ha (control), A1 = 7 tons / ha (equivalent to 31.5 g / pot). Factor II: the dose of goat manure (K) consists of 3 levels K0 = 0 tons / ha (control), K1 = 5 tons / ha (equivalent to 22.5 g / pot), K2 = 10 tons / ha (equivalent to 45 g / pot) and K3 = 15 tons / ha (equivalent to 67.5 g / pot). If the results of the analysis have a significant effect, further testing with the Duncan

Multiple Range Test at the 5% level and the 1% level.

The preparation of azolla research was cultivated in containers with a diameter of 1.3 meters using top soil. For 1 week. Goat manure is composted for 2 weeks until it turns brown and odorless. Then goat and azolla mortar are applied according to treatment. Azolla that has been applied to each experiment pot as much as 7 tons / ha is left for 1 week until azolla increases, then azolla is weighed, after that azolla is returned again to the experimental pot and then immersed for 4 weeks.

After incubating the treatment for 4 weeks, soil analysis before planting was carried out, namely pH, C-organic, N-total. Soil analysis after incubation was carried out before applying urea fertilizer. The application of basic fertilizer ie NPK is given by immersing it in the soil for each treatment with a dose: urea 200 kg urea / ha (0.90 g urea / pot), SP-36 100 kg SP-36 / ha (0.45 g SP- 36 / pot), KCl 75 kg KCl / ha (0.33 g KCl / pot). P and K fertilizers are given simultaneously the day before planting. Urea fertilizer is given 3 times at a dose of 1/3 when planting, 1/3 when the plant is 25 days after planting, 1/3 when the plant is 35 days after planting. Seedlings are planted 3 seeds /pot, carried out maintenance such as pest and disease control. Harvesting is done at the end of the vegetative period, then analysis of plant N levels and plant N uptake.

RESULTS AND DISCUSSION

C-Organic Soil (%) and N-Total (%)

Azolla factor has a significant effect on increasing C-organic soil and N-total (Tables 1 and 2). Azolla has a high content of C-Organic (33.48%) and N (4.24%), so azolla is able to increase N nutrient content, increase biological activity, improve soil physical and chemical conditions for the better (Setiawati, 2014).

The provision of goat manure has a significant effect on increasing C-organic soil. The highest C-organic soil content was found in the K3 treatment (Table 1). It can be seen that with the increase of goat manure dosage in line with the increase in soil C-organic content because goat manure itself has a high C-organic content of 13.17%. (Handayani, 2011).

Table 1. Soil C-organic content due application azolla and goat manure

Azoll (ton/ha)	Goat Manure (ton/ha)				Average
	K0 (0)	K1 (5)	K2 (10)	K3 (15)	
	----------%----------				
A0 (Azolla 0 ton/ha)	0,43	1,03	1,27	1,00	0,93 bB
A1 (Azolla 7 ton/ha)	1,01	1,29	1,29	1,60	1,30 aA
Average	0,72 cC	1,16 bcBC	1,28 abAB	1,30 aA	

Note: Numbers in columns and rows followed by the same letter are not significantly different at the 5% level and the 1% level according to the DMRT test

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Table 2. N-total soil due application azolla and goat manure.

Azoll (ton/ha)	Goat Manure (ton/ha)				Average
	K0 (0)	K1 (5)	K2 (10)	K3 (15)	
	----------%----------				
A0 (Azolla 0 ton/ha)	0,152	0,157	0,162	0,169	0,160 b
A1 (Azolla 7 ton/ha)	0,316	0,167	0,171	0,168	0,168 a
Average	0,158	0,162	0,167	0,168	

Note: Numbers in columns and rows followed by the same letter are not significantly different at the 5% level according to the DMRT test

Number of tillers per clumps

Factors of goat manure significantly affect the number of tillers. The highest number of tillers was in the K3 treatment (Table 3). This shows that the nutrient N is an element that is quickly visible effect on plant growth. The main role of N nutrients is to stimulate vegetative growth (stems and leaves), increase the number of tillers, increase the number of grains per clumps (Rauf *et al*. 2011).

Heading Dry Weight (g)

Factors of goat manure have a significant effect on increasing canopy dry weight. The highest shoot dry weight was in treatment K1 (Table 4). This is because goat manure gives nutrients N in the vegetative and generative plant growth periods in which N nutrients will accumulate and can stimulate the formation of more tillers which will affect the dry weight of the rice canopy. (Nurmayulis, 2011).

The interaction between azolla and goat manure also significantly increased the canopy dry weight. The highest interaction of canopy dry weight was at A1K1 treatment (Table 4). This shows that plants absorb nutrients from organic fertilizer that is given well for growth and development of the number of tillers which is very influential on the dry weight of the canopy. According to Abu *et al.* (2017), the dry weight of plants illustrates the amount of nutrient absorption and utilization of solar radiation available during growth by plant canopy, especially leaves.

Table 3. Number of tillers 8 Week After Planting due application azolla and goat manure

Azoll (ton/ha)	Goat Manure (ton/ha)				Average
	K0 (0)	K1 (5)	K2 (10)	K3 (15)	
	----------Tillers per clumps ----------				
A0 (Azolla 0 ton/ha)	34	44	43	46	42
A1 (Azolla 7 ton/ha)	36	43	40	43	41
Average	35 b	44 a	42 ab	45 a	

Note: Numbers in columns and rows followed by the same letter are not significantly different at the 5% level according to the DMRT test

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Table 4. Canopy dry weight (g) due application of azolla and goat manure

Azoll (ton/ha)	Goat Manure (ton/ha)				Average
	K0 (0)	K1 (5)	K2 (10)	K3 (15)	
	----------g----------				
A0 (Azolla 0 ton/ha)	41,26 c	55,95abc	60,38 abc	68,70 ab	56,57
A1 (Azolla 7 ton/ha)	50,40bc	75,46 a	60,10 abc	44,380 c	57,58
Average	45,84 b	65,70 a	60,24 a	56,54 ab	

Note: Numbers in columns and rows followed by the same letter are not significantly different at the 5% level according to the DMRT test

Plant N content (%) and Plant N uptake (g per clump)

Azolla factor and goat manure significantly affect plant N levels and plant N uptake, while the interaction of both has significant effect on plant N uptake. The highest levels of plant N and plant N uptake due to the administration of goat manure were found in the K2 and K3 treatments (Table 5), while the highest interaction with the plant N uptake was in the A1K1 treatment (Table 6). This shows that Azolla and goat manure can provide N nutrients for rice plants.

According Soedharmono *et al.* (2016) azolla is able to fix N2 from the air that is symbiotic with anabaena azollae assisted by nitrogense enzymes, so that N can be utilized by plants.

Increasing the dose of goat manure may not necessarily be able to increase plant N uptake, where nitrogen uptake during plant growth is not all the same even at the same fertility rate. The amount of nitrogen absorbed by plants every day is the maximum weight of the plants when the plants are still young and gradually decreases with increasing plant age. Goat manure itself has an N content of 0.68%.

Table 5. Plant N levels (%) due application of azolla and goat manure in various doses

Azoll (ton/ha)	Goat Manure (ton/ha)				Average
	K0 (0)	K1 (5)	K2 (10)	K3 (15)	
	----------%----------				
A0 (Azolla 0 ton/ha)	1,473 c	1,723 bc	2,726 ab	2,961 a	2,220 b
A1 (Azolla 7 ton/ha)	2,522 ab	3,149 a	2,867 a	2,616 ab	2,788 a
Average	1,997 b	2,436 ab	2,796 a	2,788 a	

Note: Numbers in columns and rows followed by the same letter are not significantly different at the 5% level according to the DMRT test

Table 6. Plant N uptake (mg N /plant) due to application of azolla and goat manure in various doses

Azoll (ton/ha)	Goat Manure (ton/ha)				Average
	K0 (0)	K1 (5)	K2 (10)	K3 (15)	
	----------mg N/plant----------				
A0 (Azolla 0 ton/ha)	610,11 dD	962,42 dC	1664,53 bcBC	2060,29 abAB	1324,34 b
A1 (Azolla 7 ton/ha)	1117,97 cdC	2672,23 aA	1265,65 cdBC	1670,03 bcBC	1681,46 a
Average	864,03 bB	1817,34 aA	1465,09 aA	1865,15 aA	

Note: Numbers in columns and rows followed by the same letter are not significantly different at the 5% level and the 1% level according to the DMRT test

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